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A NOTE ON THE ASSAY OF THE ORGANIC SALTS OF POTASSIUM AND SODIUM IN THE U. S. PHARMACOPŒIA.

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As is well known, the U. S. Pharmacopœia requires an assay method for the organic salts of potassium and sodium[1] which involves carbonization, extraction of the residue with boiling distilled water until the washings cease to react with methyl orange, and the subsequent titration of the filtrate by means of standard acid. But it has been shown by Seidell and Wilbert,[2] in the case of sodium benzoate, "that even in spite of the greatest care the unburned carbon left after the extraction of the incinerated residue retains an appreciable amount of alkali, and therefore in order to obtain satisfactory results it is necessary to make a second ignition of this unburned and extracted carbon, and add the solution of the second residue to that of the first, before making the titration for the total alkali." They therefore recommend a modified procedure in which the sample "is ignited thoroughly in a platinum dish," the residue extracted with hot water and the solution filtered through an ashless filter, the unburned carbon washed several times, and then returned together with the filter paper to the platinum dish and ignited. The second residue is dissolved in water and added to the filtered extract of the first residue and then titrated with standard acid.

Seidell and Wilbert report results on sodium benzoate only. But inasmuch as essentially the same quantitative test which the

[1] U. S. Pharmacopœia (1905), pp. 355, 357, 360, 362, 395, 396–397, 402, 410.
[2] Amer. Jour. Pharm., **82**, 67–68 (1910).

U. S. P. requires in the case of sodium benzoate, is also required in the cases of other U. S. P. organic salts of potassium and sodium, their criticism of the U. S. P. method probably applies there equally well. However, it is to be noted that the U. S. P. cautions the operator with regard to the degree of heat which may be applied. Thus, in most instances, the U. S. P. directions are that the substance be "carbonized at a temperature not exceeding red heat," the reason for this probably being that otherwise loss may occur. As a matter of fact, loss was actually found to occur in the case of a sample of sodium benzoate even when ignited by means of an ordinary Bunsen burner, but having the platinum dish loosely covered with a piece of platinum foil. It appears necessary, therefore, that some other method be adopted if uniformly accurate results are to be obtained.

In this connection it occurred to the writer that probably a safer procedure might be based on the transformation of the potassium and sodium into their highly stable and non-volatile sulphates, which is a procedure often used in organic analysis, and a form of which is actually adopted by the present U. S. P. in the case of the organic salts of lithium. As a result of some preliminary experiments, with regard to the most suitable strength of sulphuric acid to use, the amount of excess of acid that is necessary and sufficient, and other conditions tending to eliminate spirting in the final operations, the following procedure was found to yield satisfactory results.

Mode of Procedure.

Portions of the various samples in powdered form, generally about 0.5 Gm. of each, were placed in platinum dishes (100 c.c.), dissolved in a sufficient amount of hot water, and treated with an amount of N/1 H_2SO_4 which was about a third or a half in excess of that theoretically required. In those cases where the solubility of the salts in the acid solution used was sufficient to finally yield a clear solution, the preliminary solution in hot water was omitted. In each case, the dish was then placed on a boiling water bath and the contents allowed to evaporate as much as possible. The dish was then covered with a piece of platinum foil and placed in a drying oven, the temperature of which was gradually increased from about 100° C. to about 150° C. Generally, it was allowed to remain in the drying oven for about 30 minutes. It was then ignited by means of a Bunsen burner while still loosely covered by

the platinum foil, increasing the temperature gradually up to red heat, and continuing the ignition at red heat for 10–15 minutes. It was then cooled and weighed in the usual way and the ignition repeated for another interval of 10 minutes. Usually, the weight after the second ignition was practically the same as after the first; and hence the results obtained after the second ignition were usually accepted as final. That the first ignition had in most instances really effected the complete change was indicated also by the perfectly white color of the residue. Various samples of potassium acetate, potassium bitartrate, potassium citrate, potassium and sodium tartrate, sodium acetate, sodium benzoate, sodium citrate, and sodium salicylate, obtained from different American firms, were assayed by the above method. In the case of the potassium acetate, however, owing to its very deliquescent nature, the above procedure was slightly modified as follows: An amount of the sample, judged to be sufficient for the analysis, was quickly transferred into a comparatively wide weighing bottle, and weighed. The uncovered weighing bottle was then placed in a drying oven and allowed to remain there for one hour at 105° C. After cooling in a desiccator, its weight was again determined and the contents were transferred into the platinum dish with the aid of the N/1 H_2SO_4 and the weighing bottle was washed with distilled water, adding the washings to the contents of the dish. From this point the procedure was the same as in the other cases. The results obtained are given in the following tables:

TABLE I.

Showing Degree of Purity of Various Samples of Commercial Potassium Citrate, $K_3C_6H_5O_7+H_2O$.

No. of Sample	Amount Taken for Analysis	Weight of K_2SO_4 Found	Theory for K_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
5	0.5022	0.3933	0.4046	97.21
4	0.5015	0.3994	0.4040	98.86
8	0.5006	0.3989	0.4033	98.91
12	0.5008	0.3992	0.4034	98.96
11	0.5009	0.4004	0.4035	99.23
3	0.5000	0.4002	0.4028	99.35
2	0.5011	0.4012	0.4037	99.38
10	0.5032	0.4036	0.4054	99.56
9	0.5021	0.4031	0.4045	99.65
1	0.5028	0.4043	0.4051	99.80
7	0.5014	0.4037	0.4039	99.95

TABLE II.

Showing Degree of Purity of Various Samples of Commercial Potassium Bitartrate, $KHC_4H_4O_6$.

No. of Sample	Amount Taken for Analysis	Weight of K_2SO_4 Found	Theory for K_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
11	0.5018	0.2301	0.2322	99.10
2	0.5000	0.2302	0.2314	99.48
3	0.5009	0.2306	0.2318	99.48
4	0.5010	0.2309	0.2319	99.57
12	0.5002	0.2306	0.2315	99.61
5	0.5012	0.2329	0.2320	99.61*
10	0.5013	0.2313	0.2320	99.70
8	0.5025	0.2322	0.2326	99.83
9	0.5019	0.2321	0.2323	99.91
7	0.5016	0.2320	0.2321	99.96
1	0.5013	0.2321	0.2320	99.96*
6	0.5012	0.2320	0.2320	100.00

* The sign (*) by the side of any of the percentage figures, in this and the following tables, indicates that the sulphate found exceeded the theoretical 100 per cent. by as much as the figure in the table is less than 100 per cent.

TABLE III.

Showing Degree of Purity of Various Samples of Commercial Potassium Sodium Tartrate, $KNaC_4H_4O_6+4H_2O$.

No. of Sample	Amount Taken for Analysis	Weight of $K_2SO_4+Na_2SO_4$	Theory for $K_2SO_4+Na_2SO_4$	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
2	0.5035	0.2907	0.2821	96.96*
10	0.5011	0.2834	0.2807	99.04*
5	0.5013	0.2832	0.2808	99.15*
7	0.5011	0.2827	0.2807	99.29*
4	0.5035	0.2840	0.2821	99.33*
1	0.5022	0.2822	0.2813	99.68*
9	0.5010	0.2811	0.2807	99.86*
3	0.5028	0.2820	0.2817	99.89*
8	0.5029	0.2816	0.2817	99.96
6	0.5028	0.2816	0.2817	99.96

* See footnote to Table II.

TABLE IV.

Showing Degree of Purity of Various Samples of Commercial Potassium Acetate, $KC_2H_3O_2$.

No. of Sample	Amount Taken for Analysis	Loss on Drying at 105° for One Hour	Weight of K_2SO_4 Found	Theory for K_2SO_4†	Percentage Loss on Drying at 105° for One Hour	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	(*Gm.*)		
5	1.3810	0.0908	1.0412	1.1454	6.57	90.90
7	1.1640	0.0123	0.9473	1.0224	1.05	92.65
11	1.5545	0.0451	1.2505	1.3400	2.90	93.32
2	1.6206	0.1105	1.2513	1.3406	6.82	93.34
6	1.4194	0.0267	1.1902	1.2363	1.88	96.27
8	1.0180	0.0115	0.8810	0.8935	1.13	98.60
12	1.2257	0.0090	1.0674	1.0801	0.74	98.83
4	0.9911	0.0157	0.8597	0.8659	1.59	99.28
10	1.6336	0.0180	1.4258	1.4342	1.10	99.41
1	1.5622	0.0192	1.3626	1.3698	1.23	99.47
9	1.5973	0.0260	1.3876	1.3949	1.63	99.48
3	0.9461	0.0664	0.7796	0.7809	7.02	99.83

† Calculated on basis of the weight of the salt after drying.

TABLE V.

Showing Degree of Purity of Various Samples of Commercial Sodium Benzoate, $NaC_7H_5O_2$.

No. of Sample	Amount Taken for Analysis	Weight of Na_2SO_4 Found	Theory for Na_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
2	0.5000	0.2817	0.2465	85.72*
4	0.5000	0.2399	0.2465	97.33
8	0.5008	0.2405	0.2469	97.41
1	0.5000	0.2404	0.2465	97.53
10	0.5008	0.2410	0.2469	97.61
9	0.5007	0.2423	0.2468	98.18
7	0.5000	0.2428	0.2465	98.50
3	0.5000	0.2442	0.2465	99.07
5	0.5000	0.2442	0.2465	99.07

*See footnote to Table II.

TABLE VI.

Showing Degree of Purity of Various Samples of Commercial Sodium Citrate, $2Na_3C_6H_5O_7+11H_2O$.

No. of Sample	Amount Taken for Analysis	Weight of Na_2SO_4 Found	Theory for Na_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
11	0.5019	0.3573	0.2994	80.66*
8	0.5006	0.3266	0.2987	90.66*
5	0.5016	0.3166	0.2993	94.22*
2	0.5016	0.3036	0.2993	98.56*
1	0.5021	0.3022	0.2996	99.13*
4	0.5000	0.3005	0.2983	99.26*
7	0.5012	0.3010	0.2990	99.33*
3	0.5004	0.3002	0.2985	99.43*
10	0.5015	0.2982	0.2992	99.67
9	0.5015	0.2999	0.2992	99.77*

*See footnote to Table II.

TABLE VII.

Showing Degree of Purity of Various Samples of Commercial Sodium Salicylate, $NaC_7H_5O_3$.

No. of Sample	Amount Taken for Analysis	Weight of Na_2SO_4 Found	Theory for Na_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
2	0.5007	0.2133	0.2222	95.99
12	0.5007	0.2208	0.2222	99.37
1	0.5008	0.2211	0.2223	99.46
5	0.5001	0.2231	0.2219	99.46*
4	0.5016	0.2218	0.2226	99.64
9	0.5006	0.2228	0.2222	99.73*
3	0.5000	0.2214	0.2219	99.77
10	0.5000	0.2214	0.2219	99.77
7	0.5000	0.2224	0.2219	99.78*
8	0.5005	0.2221	0.2221	100.00

*See footnote to Table II.

TABLE VIII.

Showing Degree of Purity of Various Samples of Commercial Sodium Acetate, $NaC_2H_3O_2+3H_2O$.

No. of Sample	Amount Taken for Analysis	Weight of Na_2SO_4 Found	Theory for Na_2SO_4	Purity of Sample Expressed in Percentage
	(*Gm.*)	(*Gm.*)	(*Gm.*)	
9	0.5018	0.2640	0.2619	99.20*
11	0.5004	0.2594	0.2612	99.31
5	0.5015	0.2605	0.2618	99.50
6	0.5010	0.2603	0.2615	99.54
7	0.5010	0.2607	0.2615	99.69
8	0.5009	0.2607	0.2615	99.69
2	0.5010	0.2611	0.2615	99.85
3	0.5023	0.2626	0.2622	99.85*
4	0.5013	0.2620	0.2617	99.89*
12	0.5000	0.2608	0.2610	99.92
10	0.5005	0.2611	0.2613	99.93
1	0.5020	0.2621	0.2620	99.96*

*See footnote to Table II.

Seidell and Wilbert [3] found, in the case of sodium benzoate, that even when using their modification of the U. S. P. method, none of the samples which they examined complied with the U. S. P. purity requirement of "not less than 99 per cent." Their highest result, when using their modification, is 97.6 per cent.; and by the U. S. P. method, their highest result is only 94.7 per cent. This, therefore, opens up the question whether the percentage purity requirements, in the cases of the other U. S. P. organic salts of potassium and sodium, are not equally difficult to meet. The results given in the above tables are of interest, therefore, in showing how near an agreement there is between the U. S. P. purity requirements for these salts and the actual conditions of these salts on the American market, when assayed by the procedure above described.

The results given in Table I show that the greater number of the samples of potassium citrate examined complied with the U. S. P. requirement that the purity be not less than 99 per cent. Of the samples whose purity was found to be less than 99 per cent., the results in three cases (Nos. 4, 8, and 12) are so close to 99 per cent. that for all practical purposes it may be said that they, too, comply with the U. S. P. requirement. In other words, only one (No. 5) of the eleven samples of potassium citrate examined was found to

[3] *Loc. cit.*

be of a considerably lower purity than the U. S. P. requirement of 99 per cent. We may conclude, therefore, that the requirement of 99 per cent. is entirely reasonable and that the potassium citrate on the American market meets this requirement in nearly all the cases examined.

The results given in Table II show that the 12 samples of potassium bitartrate examined were all found to be of a very high degree of purity, the greater number showing a purity of over 99.5 per cent., and none were found to be of a lower purity than 99 per cent. The U. S. P. purity requirement of "not less than 99 per cent." must therefore be regarded as very reasonable.

The results given in Table III show that, of the 10 samples of potassium sodium tartrate examined, all but one were found to have a purity of over 99 per cent. The U. S. P. purity requirement for this salt of "not less than 99 per cent." is therefore reasonable; and it seems that nearly all of the potassium sodium tartrate on the American market complies with this U. S. P. requirement.

The results given in Table IV show that, of the 12 samples of potassium acetate examined, more than half were of a purity of over 98.5 per cent., calculated on the basis of the weight after drying at 105° C. for one hour. The U. S. P. requirement of a purity of not less than 98 per cent. must, therefore, be regarded as quite reasonable. However, it is to be noted that the present U. S. P. does not limit the amount of moisture which the salt may contain; and since this salt is very deliquescent, the amount of moisture which it may have absorbed may be very considerable. Thus, one sample (No. 3) was found to have lost over 7 per cent. of its weight when dried at 105° C. for one hour. It would seem desirable, therefore, that in the next revision of the U. S. P., the amount of moisture which may be present should be limited. The results given here show that, of the 12 samples examined, 8 of these lost less than 2 per cent. on drying at 105° C. for one hour. It would not be unreasonable, therefore, to expect that U. S. P. potassium acetate should not lose more than 2 per cent. of its weight on drying at 105° C. for one hour.

The results given in Table V show that only 2 of the 9 samples of sodium benzoate examined complied with the U. S. P. purity requirement of "not less than 99 per cent." It is seen, however, that about half of the samples examined showed a purity of over 98 per cent.; and with the exception of only one sample (No. 2),

the found purity was in all cases quite close (within a fraction of a per cent.) to 98 per cent. It seems, therefore, that the purity of the greater portion of the sodium benzoate on the market is only about 98 per cent. This, however, cannot very well be attributed to habitual carelessness on the part of the manufacturers, since a number of the low results were obtained with the samples from manufacturers whose other salts, which were examined in this connection, were found to be of excellent purity. It is more likely, therefore, that the comparatively lower results in the case of the sodium benzoate are due to some technical difficulties met with in the manufacture of the salt on a large scale which cause the neutralization to be somewhat incomplete or lead to the absorption of some moisture. And since neither the presence of a small amount of moisture nor a very slight excess of the acid or alkali can reasonably be said to materially affect the usefulness of the salt for medicinal purposes, it is a question, therefore, whether a requirement of a minimum of 98 per cent. of the absolute salt, and a stipulation as to what the remaining 2 per cent. should consist of, would not really be preferable to the present U. S. P. requirement of 99 per cent., which seems to be a little too high for most of the manufacturers to meet.

The results given in Table VI show that, of the 10 samples of sodium citrate examined, more than half were of a purity of over 99 per cent. The acceptance by the present U. S. P. of a sodium citrate having a purity of only 97 per cent. seems, therefore, not warrantable by the actual conditions pertaining to the purity of this salt as found on the American market. With the exception of only 3 (Nos. 5, 8, and 11) of the samples examined, all were found to have a purity of over 98.5 per cent. If, therefore, the purity standard for this salt were increased from 97 per cent. to a minimum of 98.5 per cent., the change would certainly not be unreasonable and would serve to make the U. S. P. requirement more nearly in harmony with the comparatively very high purity of what seems to be the greater portion of the sodium citrate on the American market.

The results given in Table VII show that, of the 10 samples of sodium salicylate examined, 6 of these showed a purity of over 99.5 per cent. The present U. S. P. requirement of " not less than 99.5 per cent." is, therefore, not entirely unreasonable. As a minimum limit, however, 99.5 per cent. may be a trifle too high.

Thus, samples Nos. 5, 1, and 12, which showed a purity of 99.46, 99.46 and 99.37 per cent., respectively, might have to be rejected as not complying with the U. S. P. requirement, whereas, a slight deviation from perfect neutrality or presence of a small amount of moisture might easily account for those differences. It is a question, therefore, whether a requirement of not less than 99 per cent., with a statement as to what the remaining 1 per cent. should consist of, would not be sufficient and preferable.

The results given in Table VIII show that of the 12 samples of sodium acetate examined, 10 had a purity of 99.5 per cent. or over and all were over 99 per cent. pure. The statement in the present U. S. P.,[4] according to which a purity of not less than 99.5 per cent. is required for this salt when "in an uneffloresced condition" but not limiting the amount of efflorescence, seems objectionable. Since all of the samples examined showed a purity of over 99 per cent., a straight requirement of not less than 99 per cent., without any reference to efflorescence, would seem entirely reasonable and preferable to the requirement of the present U. S. P., which by the statement "in an uneffloresced condition" nullifies in a large measure the value of the test.

A NOTE ON TINCTURA CARDAMOMI COMPOSITA.

By John K. Thum, Ph.G.
Pharmacist at the German Hospital, Philadelphia.

The present pharmacopœial method for the preparation of compound tincture of cardamom possesses no advantages over the previous one when final results are considered. Of course in the present method, which is simply maceration and filtration,—and which is the German pharmacists' style for the manufacture of most of their galenicals—the disagreeable features involved in trying to percolate cinnamon and the other crude drugs contained in the preparation are avoided. Because of the pectin present in it cinnamon is extremely difficult to percolate with a menstruum of low alcoholic content; for this reason the present pharmacopœia recommends the method mentioned above. But, like the preparation made by percolation the tincture does not remain clear for any

[4] U. S. Pharmacopœia (1905), p. 394.

length of time. Filtration must be resorted to quite frequently to free it of a pectinous precipitate. To the busy pharmacist this is annoying in that it consumes time and labor. To obviate this we replace the cinnamon with the official spirit of cinnamon. As the spirit is made by dissolving the essential oil in alcohol we use just sufficient of it to approximate the amount of oil in the crude drug displaced. As this is generally regarded as about one per cent., we advise the use of 2.5 C.c. of the official spirit of cinnamon to the litre. The formula and method is as follows:

Tinctura Cardamomi Composita:

Cardamom	25.0 Gm.
Caraway	12.0 Gm.
Cochineal	5.0 Gm.
Spirits of cinnamon	2.5 C.c.
Glycerin	50.0 C.c.
Diluted alcohol, a sufficient quantity to make	1000.0 C.c.

Mix the cardamom, caraway, and cochineal, and reduce them to a moderately coarse powder (No. 40). Then moisten the powder with 25 cubic centimetres of diluted alcohol, pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it until 940 cubic centimetres are obtained; then add the spirit of cinnamon, glycerin, and sufficient of the weak percolate to make the required volume and mix.

CULTIVATION OF HYDRASTIS.

By J. L. Stingel, Cleveland School of Pharmacy.

The presumption that Hydrastis is practically extinct in many localities led the writer to undertake its cultivation under domesticated conditions. In order to secure plants it became necessary to search near-by forests. This I did in early spring as soon as the plants secured a sufficient growth to recognize them. In this way I was able to secure more plants than I was able to handle; in fact, was surprised at their number. These localities have been gone over frequently, later in the season, in previous years, but nothing of any consequence was ever found.

Cattle are a destructive factor with hydrastis, since the leaf stem makes a rapid growth and affords a delicious morsel. One can readily see what results follow when cattle are allowed access to forests containing this plant. The fruit and seed seldom mature in such localities. The increase in number of plants is brought about by formation of leaf buds on the roots, the latter of which are very abundant and assume a great length.

Cultivation.—The raising of this plant is not difficult. The condition in which it exists in its native haunts would undoubtedly be the one to follow, although this is not necessary. Shade is an important factor; one-third sunlight when artificial means (lattice work) is used gives good results.

This paper was not intended as an exhaustive study of the cultivation of Hydrastis, but to present a few views and experiences encountered while working with the drug. The writer recommends to those interested in its cultivation the reading of: Bull. Bur. Plant Ind., U. S. Dept. Agric., 1907, No. 107, The *Jr. Am. Pharm. Ass.*, 1912, ii, p. 5–12.

With the progress of civilization it is useless to assert that the number of plants is just as abundant as ever but will make the statement that there exists at the present time more Hydrastis than is usually thought to be the case, but if collected as in previous years regardless of season or preservation, etc., the plant will soon become extinct.

The scarcity of this valuable drug cannot be entirely attributed to lack of plants or extinction, but to other conditions, which tend to prevent identification at the time of collection. The only feasible solution to the present Hydrastis problem lies in cultivation.

KIESELGUHR.[1]

By Henry C. Blair.

No information is given in the books of reference used by pharmacists, except in Merck's Index, about this substance; a few manufacturers and teachers know of it and the name, Infusorial Earth, is applied to it by dealers and others, although it is incorrect.

[1] Presented to the Pennsylvania Pharmaceutical Association, June, 1912.

The name Kieselguhr is German and literally translated means Silicious Marl. This marl is a deposit found in the dry basins of prehistoric lakes and seas, particularly in Lünberger Heide, in the vicinity of Berlin, Germany, and near Bilin in Bohemia. It consists of silicic covering of dead diatoms and upon incineration leaves a residue silicic anhydride SiO_2. Usually the natural deposit is calcined so as to destroy the organic matter, then floated and dried.

Kieselguhr is marketed of various kinds from the heavy, buff-colored kind to the very light, white kind, and varies in price according to the quality and inclination of the jobber. Of the various samples secured from jobbers in Philadelphia and New York during May, 1912, all but one were labelled Infusorial Earth, and under the microscope all but one show skeletons of the diatoms and none of them show Infusoria so that they are improperly labelled.

I have been unable to procure a sample showing Infusoria and therefore conclude that Kieselguhr is Diatomaceous Earth and is not Infusorial Earth.

Technical uses for this Diatomaceous Earth are chiefly for metal and wood polishes, for manufacture of dynamite in fire-proof compositions, for insulating steam pipes and electrical insulators, also in the manufacture of liquid glass and glass, in packing for caustic or inflammable liquids, and in soap and paper-making.

In pharmacy Kieselguhr is used as a filtering medium, as diluent for powdered extracts, pills, pastes, and to obtain sterile filtrates.

The very light, white Kieselguhr is the proper grade to use in pharmacy. In Germany this grade is known as Terra Silica Calcinata Precipitata which is, of course, too much of a name for ordinary use for such a simple substance.

Kieselguhr may be easily detected under the microscope (200 to 300 diameters), as the forms of skeletons of the diatoms are recognizable, the one that predominates in most of the lighter, white varieties is called Navicula, but various other forms are always distinctly seen.

One sample obtained from a jobbing house shows neither Diatoms nor Infusoria and may not be true Kieselguhr. Also two samples show no naviculæ.

The best variety absorbs four times its weight of water.

The price of the finest quality in single pound lots is twenty-five cents.

Cotton may be used as a filter medium when the liquid contains

only large particles in suspension; it is convenient, efficient and economical.

When a filter press is used only a pulp of some sort can be used.

Talcum, the purified kind, is difficult to make and expensive to purchase. Few jobbers can supply it, and when they do, it is often little better than the commercial variety. It is soluble to an uncertain extent and for many other reasons is not always satisfactory.

Kieselguhr is about four times as efficient as Talc, and therefore, since purified talc costs the same as Kieselguhr (25 cents) it is only one-fourth as expensive to use.

A concise statement of Kieselguhr follows:

Kieselguhr, Diatomaceous Earth, Terra Silicæ, SiO_2, the silicious covering or skeletons of the Diatoms obtained from marl by incineration and levigation, absorbs four times its weight of water; distinguished under microscope by skeletons of the various Diatoms.

Pharmaceutical uses, as a filtering medium, and to obtain sterile filtrates, excipient for pills, absorptive diluent for powdered extracts and pastes, etc.

THE NEED FOR FURTHER RESTRICTING THE SALE OF POISONS AND HABIT-FORMING DRUGS.[1]

By M. I. Wilbert, Washington, D. C.

To the credit of American pharmacists it must be said that from the very origin of pharmacy in this country the followers of our craft have recognized the possible danger from the promiscuous use of poisonous substances and have persistently and consistently endeavored to secure legislation that would tend to restrict the sale and use of such drugs to legitimate needs.

While much has been accomplished in the way of restrictive legislation it is unfortunately too true that the greater portion of this legislation serves no useful purpose unless it be that the inclusion of laws in law books, by increasing their size and weight, has of itself a wholesome influence on the body politic.

It has frequently been asserted, and with apparent reason, that

[1] Presented at the meeting of the Pennsylvania Pharmaceutical Association, June 18–20, 1912.

we are burdened with laws and cursed with the non-enforcement of them to such a degree that people generally have lost the necessary respect for laws and the purpose of laws.

That there is much truth in this general assertion is borne out by the fact that since the institution of restrictive legislation relating to the sale of poisons the use of poisonous drugs for criminal purposes has steadily increased. This is evidenced by the fact that the use of poison for suicidal purposes, while a negligible factor prior to half a century ago, has had the unfortunate distinction, for a decade or more, of leading all of the other agencies, and even in the past two years it is second only to the use of firearms regarding the sale of which practically no restrictions exist at the present time.

That it is possible to materially reduce the number of suicidal deaths from any one cause by proper restrictive measures is evidenced by the statement recently made by Thos. F. Darlington, who asserts that the enforcement of a New York City Board of Health ordinance in 1906 reduced the number of suicides from the use of phenol from 343 to 36.

The toll of human lives exacted by poisons, heavy as it is, is of secondary importance to the damage that is being done by the promiscuous and all too wide-spread use of habit-forming drugs, such as opium, morphine and cocaine. Here again American pharmacists were the first to recognize the baneful effects of narcotic drugs upon the community and to agitate for laws that would afford the protection required. Some sixty years ago (1853) a committee of the American Pharmaceutical Association pointed out that: "The immense increase in the consumption of opium and its preparations is a subject that deeply concerns the well wishers of society. Their substitution for alcoholic liquids is all to frequent."

During all of the succeeding years pharmacists through their several associations have consistently agitated for laws to restrict the sale of opiates, but as yet they have been successful only in a minor degree. Thus the President of the United States in transmitting a report of the Secretary of State relative to the control of the opium traffic points out that during the past fifty years with an increase in our population of 133 per cent. there has been an increase of more than 350 per cent. in the amount of opium imported and used. Over 400,000 pounds of opium are imported annually and it is estimated that less than 15 per cent. of this quantity should suffice to meet all the legitimate needs for the drug.

This tremendous increase in the consumption of opium and its derivatives is the more startling when we remember that half a century ago the use of bromides as sedatives was practically unknown, hydrated chloral and related compounds had not been introduced, and the host of sedatives derived from the tar barrel, of which tons are now consumed annually, were not even thought of as possibilities.

In addition to the drugs enumerated above we also have the recently introduced and fiendishly effective derivatives of morphine, such as heroin and its salts, and last but by no means least important as a habit-producing drug, we have cocaine, a drug of great medicinal value that is practically indispensable on the one hand but is unequalled on the other hand as an agent for evil, in that it is capable of destroying both body and mind in a manner that is both quick and effective. Tons upon tons of coca are being used in the manufacture of cocaine, and it is estimated that 150,000 ounces of cocaine and its salts are used annually to further debase the naturally weak and the criminally inclined, and only the recording angel can tell how many and how varied are the crimes that have been committed by habitués under its baneful influence.

While it is true that nearly every State in the union has enacted laws to restrict the sale of habit-forming drugs, it must not be overlooked that many if not all of these laws are ineffective because burdened with provisos and exceptions that make them practically inoperative. A critical review of our anti-narcotic legislation also evidences the fact that up to the present time practically all of this legislation has been designed to restrict only the retail druggist and does not apply either directly or indirectly to the material sold by the manufacturer or jobber or to the drugs dispensed directly to the patient by the physician. This short-coming on the part of our State laws is undoubtedly due to the fact that while pharmacists have evidenced a willingness to have their own business restricted, they have been unable to convince legislators that the sale or the giving away of habit-forming drugs by others should also be safe-guarded in some really efficient manner.

Even the laws restricting the sale of habit-forming drugs by retail druggists are frequently ineffective because of the exceptions that are made for preparations containing supposedly innocuous doses of such drugs. These exceptions, usually embodied in the several State laws because of the general desire to avoid possible

opposition to legislation on the part of persons interested in the sale of proprietary remedies, have been the direct cause of the inability or perhaps unwillingness on the part of the State officials to enforce the existing laws, and it is largely because of this fact that some retail druggists have been found who fail to comply with the letter as well as the spirit of existing legislation.

Just at the present time the use of habit-forming drugs is attracting the attention of thinking people in all parts of the world, and the extent to which persons in different walks of life have become addicted to the use of drugs is just dawning on the public at large. The subject is being discussed frequently and with vigor in public meetings and in the daily press and the outcome is bound to produce laws that will effectually restrict and ultimately prohibit the illegitimate sale of habit-forming drugs. The momentous question before us at the present time is: Are the pharmacists of this country really in earnest in their desire to restrict the sale and use of poisons and habit-forming drugs and are they to be counted on to favor, and to insist on, the enactment of legislation that can and will be enforced?

THE CONSTITUENTS OF GELSEMIUM.[1]

By Charles Watson Moore.

Under the title of "gelsemium" several of the pharmacopœias recognize the dried rhizome and roots of *Gelsemium sempervirens,* Aiton, commonly known as the "yellow jessamine."

The medicinal value of the plant is due to the presence of certain alkaloids, only one of which, however, has been obtained in a crystalline condition.

Among the earlier investigations of gelsemium there may be noted that of Wormley (*Amer. J. Pharm.,* 1870, 42, 1), who isolated an impure alkaloidal product to which he gave the name of "gelseminine." This base was afterwards investigated by Sonnenschein (*Ber.,* 1876, 9, 1182) and Gerrard (*Pharm. J.,* 1883, 13, [iii], 641), who assigned to it the formulæ $C_{22}H_{38}O_4N_2$ and $C_{24}H_{28}O_4N_2$ respec-

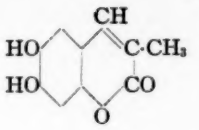
[1] From Transactions of the Chemical Society, vol. 97, 1910.

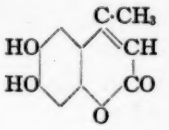
tively. The last-mentioned investigator was the first to obtain gelsemine and its salts in a crystalline state. Thompson (*Jahresber.*, 1887, 2218), who ascribed to gelsemine the formula $C_{54}H_{69}O_{12}N_4$, showed that it was accompanied in the plant by a second alkaloid, which he obtained in an amorphous condition, and which he designated as "gelseminine." Both gelsemine and gelseminine have more recently been examined by Cushny (*Ber.*, 1893, 26, 1725), who proposed the formulæ $C_{49}H_{63}O_{14}N_5$ and $C_{42}H_{47}O_{14}N_3$ respectively for the two bases. Spiegel (*Ber.*, 1893, 26, 1045) suggested the formula $C_{22}H_{26}O_3N_2$ for the crystalline base, which was confirmed by Gœldner (*Ber. deut. pharm. Ges.*, 1895, 5, 330), who obtained it in colorless crystals, melting at 160°.

Some confusion has arisen as to the nomenclature of the two bases isolated from gelsemium; thus in the English literature the crystalline base is referred to as gelsemine, and the amorphous product as gelseminine, whilst most of the German investigators, for example, Spiegel (*loc. cit.*) and Gœldner (*loc. cit.*), use these names in the opposite sense. In this communication the English nomenclature is adhered to.

The present investigation has resulted in the isolation of the alkaloid gelsemine in a pure crystalline condition. The base is found to melt considerably higher than has hitherto been recorded (m. p. 178°, instead of 160°), and it has been conclusively shown to possess the formula $C_{20}H_{22}O_2N_2$. Besides gelsemine and gelseminine, the presence of a third alkaloidal substance in gelsemium has been established. This substance is weakly basic and amorphous, but possesses strongly toxic properties.

It was shown by Wormley (*loc. cit.*) that gelsemine was accompanied in the plant by an acidic substance, which he called "gelseminic acid," an observation which has been confirmed by the present author. Gelseminic or "gelsemic" acid has been shown by Schmidt (*Arch. Pharm.*, 1898, 236, 236) to be a monomethyl ether of æsculetin (4:5-dihydroxycoumarin). Two æsculetin monomethyl ethers are known, which have been incorrectly termed α- and β-methylæsculetin respectively (compare *Beilstein's Handbuch*, III., 568), the compound from gelsemium having been given by Schmidt the latter designation. It is evident, however, that the names α- and β-methylæsculetin can only be correctly applied to substances possessing the following formulæ respectively (Pechmann and Kraft, *Ber.*, 1901, 34, 423):





Gelseminic acid is, therefore, æsculetin 4-(or-5)monomethyl ether, and it is considered desirable to retain for this substance the name "scopoletin," as proposed by Eykman (*Rec. trav. chim.*, 1884, 3, 171), who first obtained it from the rhizome of *Scopolia japonica*. The fluorescent substance, known as β-methylæsculetin, which is contained in the bark of *Prunus serotina* and in jalap (*Trans.*, 1909, 95, 243; *J. Amer. Chem. Soc.*, 1910, 32, 93) would accordingly be more appropriately termed scopoletin.

A summary of the results of the complete investigation of gelsemium, is given at the end of this paper.

Experimental.

The material employed in this investigation consisted of the dried rhizome and roots of *Gelsemium sempervirens*, Aiton.

A portion (20 grams) of the crushed drug was extracted successively in a Soxhlet apparatus with various solvents, when the following amounts of extract, dried at 100°, were obtained:

Petroleum (b. p. 35–50°)	extracted	0.39	gram =	1.95	per cent.
Ether	"	0.16	"	0.80	"
Chloroform	"	0.34	"	1.70	"
Ethyl acetate	"	0.16	"	0.80	"
Alcohol	"	1.63	"	8.15	"
Total		2.68	grams =	13.40	

For the purpose of a complete examination, 49.44 kilograms of the ground material were completely extracted with hot alcohol. After the removal of the greater portion of the alcohol, a viscid, dark-colored extract was obtained, amounting to 9.20 kilograms.

Distillation of the Extract with Steam.

A quantity (2 kilograms) of the above-mentioned extract, representing about 10.75 kilograms of the drug, was mixed with water, and steam passed through the mixture for some hours. The distillate, which amounted to 5 litres, contained some drops of oil

floating on the surface. It was extracted with ether, the ethereal liquid being dried and the solvent removed, when a small quantity of an essential oil was obtained. This was a very pale yellow liquid, and amounted to about 2 grams, being thus equivalent to about 0.019 per cent. of the weight of the drug.

Non-volatile Constituents of the Extract.

After the distillation of the extract with steam, as described above, there remained in the distillation flask a quantity of a brown resin (A) and a dark-colored aqueous liquid (B). The resin was collected, and repeatedly washed with water until nothing further was removed, the washings being added to the above-mentioned aqueous liquid.

This resin was a brown, viscid solid, and amounted to 412 grams. It was dissolved in alcohol and mixed with purified sawdust, the thoroughly dried mixture being then successively extracted in a Soxhlet apparatus with petroleum (b. p. 35–50°), ether, chloroform, ethyl acetate, and alcohol.

Petroleum Extract of the Resin (A).

Isolation of Pentatriacontane, $C_{35}H_{72}$, *and Emodin Monomethyl Ether.*

The petroleum extract, which formed a brown, semi-liquid mass and amounted to 224 grams, was dissolved in 2 litres of warm ether and the solution kept for some days, when a small quantity of an almost colorless substance separated. This was collected and washed with a little ether, after which it was distilled under diminished pressure. The distillate, which rapidly solidified, was crystallized from ethyl acetate, when it was obtained in small, colorless, glistening leaflets, melting at 75°. (Found, C = 84.9; H = 14.5. Calc., C = 85.4; H = 14.6 per cent.)

This substance was therefore pentatriacontane.

The ethereal liquid, from which the pentatriacontane had been removed as above described, was extracted with successive portions of an aqueous solution of sodium carbonate, and finally washed with water. The alkaline liquids and washings were united, acidified, and extracted with ether, when 15 grams of a viscid, oily liquid were obtained. On distilling this liquid under diminished pressure, it passed over between 245° and 255°/25 mm., and then became almost

solid. It consisted of a mixture of fatty acids, which were examined in connection with a similar product obtained from the non-acidic portion of the petroleum extract after its hydrolysis.

The ethereal liquid, from which the pentatriacontane and free fatty acids had been removed, as above described, was subsequently shaken with a solution of sodium hydroxide. The alkaline extracts, which had assumed a red color, were acidified and extracted with ether, when a very small quantity of an orange-yellow substance was obtained. This when crystallized from ethyl acetate formed orange-red prisms, which melted at about 190°, and when mixed with a little emodin monomethyl ether, fusion occurred at the same temperature. The quantity so obtained was too small for analysis, but the substance appeared to be emodin monomethyl ether (m. p. 195°), since on heating for a short time with concentrated sulphuric acid it gave a substance soluble in aqueous sodium carbonate and agreeing in its properties with emodin.

Isolation of a Phytosterol, $C_{27}H_{46}O$.

The ethereal liquid which had been extracted with alkalis, as above described, was evaporated, when a quantity of an oily product was obtained. This was hydrolyzed by heating with an alcoholic solution of potassium hydroxide, the alcohol removed, water added, and the alkaline liquid extracted with ether. The ethereal solution was washed, dried, and the solvent removed, when a quantity of brown resinous material was obtained. This was extracted with cold absolute alcohol, in which only a small portion dissolved. The alcoholic solution was concentrated, and a little water added, when, on keeping, a substance separated in flat needles, which after recrystallization from a mixture of dilute alcohol and ethyl acetate formed glistening, flat needles, melting at 136°. The amount of this substance was 1.5 grams:

0.1600, on heating at 110°, lost 0.0072 H_2O. $H_2O = 4.5$.
0.1336* gave 0.4110 CO_2 and 0.1455 H_2O. $C = 83.9$; $H = 12.1$.
$C_{27}H_{46}O,H_2O$ requires $H_2O = 4.5$ per cent.
$C_{27}H_{46}O$ requires $C = 83.9$; $H = 11.9$ per cent.

This substance thus agrees in composition with a phytosterol,

* Anhydrous substance.

and it yielded the color reaction of that class of compounds. A determination of its rotatory power gave the following result:

0.2393, made up to 20 c.c. with chloroform, gave α_D −0°58′ in a 2-dcm. tube, whence $[\alpha]_D$ −40.4°.

The *acetyl* derivative, when crystallized from acetic anhydride, separated in needles melting at 125–127°.

The brown resinous material, from which the phytosterol had been removed by extraction with alcohol, as above described, was thoroughly examined, but nothing definite could be isolated from it. It appeared to consist of a mixture of hydrocarbons.

Identification of the Fatty Acids.

The alkaline aqueous solution of potassium salts, from which the phytosterol had been removed by extraction with ether, as above described, was acidified and again extracted with ether, the ethereal solution being washed, dried, and the solvent removed. A quantity (10 grams) of fatty acids was thus obtained, which, when distilled under diminished pressure, passed over between 240° and 260°/25 mm. As these acids distilled within the same range of temperature as those previously obtained, which existed in the drug in the free state, for the purpose of their examination the two portions were mixed.

Twenty grams of the mixed acids were converted into their lead salts, and the latter digested with ether, when a portion dissolved. Both the soluble and insoluble portions were decomposed by hydrochloric acid, and the regenerated fatty acids purified by distillation under diminished pressure. The soluble portion of the lead salts yielded 11 grams of liquid acids, while the insoluble portion gave 8 grams of solid acids.

The Liquid Acids.—These acids, when distilled under diminished pressure, passed over at about 225°/15 mm. An analysis and a determination of the iodine value gave the following results:

0.1430 gave 0.4030 CO_2 and 0.1518 H_2O. C = 76.8; H = 11.8.
0.4224 absorbed 0.6783 iodine. Iodine value = 160.
$C_{18}H_{34}O_2$ requires C = 76.6; H = 12.1 per cent. Iodine value = 90.1.
$C_{18}H_{32}O_2$ requires C = 77.1; H = 11.4 per cent. Iodine value = 181.4.

In order to obtain more definite information respecting the nature of the above mixture, a quantity of it was oxidized according to the method described by Lewkowitsch (*Chemical Technology and Analysis of Oils, Fats, and Waxes,* 1904, Vol. I., p. 360). This resulted in the formation of tetrahydroxystearic acid (m. p. 157–160°) and a small quantity of dihydroxystearic acid (m. p. 125–127°). It may thus be concluded that the liquid acids consisted chiefly of a mixture of oleic and linolic acids, the latter in predominating amount.

The Solid Acids.—These acids melted at about 55°, and on analysis gave the following result:

0.1383 gave 0.3842 CO_2 and 0.1590 H_2O. C = 75.8; H = 12.7.
$C_{16}H_{32}O_2$ requires C = 75.0; H = 12.5 per cent.
$C_{18}H_{36}O_2$ requires C = 76.1; H = 12.7 per cent.

From this result it would appear that the solid acids consisted of a mixture of palmitic and stearic acids, the latter predominating.

Ethereal Extract of the Resin.

Isolation of Ipuranol, $C_{23}H_{38}O_2(OH)_2$.

This extract was a brown, amorphous mass, and amounted to 10 grams. It was redissolved in about 500 c.c. of warm ether and kept for some days, when a small quantity of an almost colorless, amorphous substance separated. This was collected and crystallized from a mixture of pyridine and dilute alcohol, when it formed microscopic needles, melting at 290°. (Found, C = 72.3; H = 10.5; Calc., C = 72.6; H = 10.5 per cent.)

This substance was thus identified as ipuranol, and when treated with sulphuric acid and acetic anhydride it yielded the color reaction shown by this compound. From it was also prepared diacetylipuranol, which separated from acetic anhydride in glistening leaflets, melting at 162°.

The ethereal solution from which the ipuranol had been separated, as above described, was examined, but nothing definite was isolated from it.

The chloroform, ethyl acetate, and alcohol extracts of the resin amounted to 35, 36, and 95 grams respectively, and consisted entirely of amorphous products.

Examination of the Aqueous Liquid (B).

Isolation of Scopoletin.

This liquid, as already indicated, represented that portion of the original alcoholic extract of the drug which was soluble in cold water, and from which the previously-described resin (A) had been removed.

It was thoroughly extracted with chloroform, these extracts being washed, dried, and the solvent removed. A quantity (about 5 grams) of a crystalline compound was thus obtained, which, after recrystallization from alcohol, formed long, almost colorless needles, melting at 204°. Its alkaline solution showed a fine blue fluorescence.

0.1430 gave 0.3286 CO_2 and 0.0550 H_2O. C = 62.6; H = 4.2
$C_{10}H_8O_4$ requires C = 62.5; H = 4.2 per cent.

A methoxyl determination by means of Perkin's modification of the Zeisel method gave the following result:

0.2132 gave 0.2584 AgI. OMe = 16.0.
$C_9H_5O_3.OMe$ requires OMe = 16.1 per cent.

The substance is thus identified as scopoletin, a methyl ether of æsculetin.

Its acetyl derivative separates from acetic anhydride in colorless leaflets, melting at 177°.

Dibromoscopoletin, $C_{10}H_6O_4Br_2$.—Five grams (six atoms) of bromine were added to a solution of scopoletin (2 grams) in about 50 c.c. of chloroform. Hydrogen bromide was slowly evolved, but the liquid did not become colorless. After keeping some hours, a crystalline substance separated, which was removed and recrystallized from alcohol, when it formed yellow, glistening plates, melting at 249°:

0.1682 gave 0.1800 AgBr. Br = 45.5.
$C_{10}H_6O_4Br_2$ requires Br = 45.7 per cent.

This substance is therefore a *dibromoscopoletin.*

Dibromoscopoletin is sparingly soluble in ether, chloroform, or

alcohol, and its solution in alkalis shows a very intense green fluorescence.

The two bromine atoms in dibromoscopoletin appear to be in the benzene nucleus, as this substance instantly decolorizes a cold alkaline solution of potassium permanganate, and, therefore, still contains a double linking. In this respect it resembles the dibromocoumarin described by Perkin (Trans., 1870, 23, 371).

On heating dibromoscopoletin with acetic anhydride, it is readily acetylated. The *acetyl* derivative forms colorless prisms, melting at 224°.

Isolation of Gelsemine, $C_{20}H_{22}O_2N_2$.

The aqueous liquid from which the scopoletin had been removed, as above described, was extracted with successive portions of amyl alcohol. This, however, only removed small quantities of an amorphous nitrogenous product, which was non-basic, and from which nothing definite could be isolated. The liquid was accordingly rendered alkaline with sodium carbonate and thoroughly extracted with ether, the combined ethereal extracts being washed, dried, and the solvent removed. A quantity of a pale yellow product was thus obtained, which crystallized very readily from acetone in handsome, glistening prisms, melting at 175–178°. After recrystallization from the same solvent, its melting point was constant at 178°. The quantity isolated amounted to 12 grams. It gave all the usual reactions characteristic of alkaloids:

1.1448, when heated at 120°, lost 0.1774 acetone. $C_3H_6O = 15.5$.
0.1594* gave 0.4353 CO_2 and 0.0980 H_2O. $C = 74.5$; $H = 6.8$.
0.3458* gave 27.5 c.c. N_2 at 27° and 754 mm. $N = 8.7$.
$C_{20}H_{22}O_2N_2$ requires $C = 74.5$; $H = 6.8$; $N = 8.7$ per cent.
$C_{20}H_{22}O_2N_2, C_3H_6O$ requires $C_3H_6O = 15.3$ per cent.

This substance, therefore, corresponds with the crystalline alkaloid, gelsemine, which has previously been isolated from gelsemium, and for which, as already mentioned, several empirical formulæ have been suggested. The fact that gelsemine crystallizes from acetone with one molecule of this solvent (see above) was confirmed by mixing 1 gram of the air-dried preparation with 20 c.c. of water and distilling the liquid. On adding *p*-bromophenylhydrazine to the distillate, a crystalline precipitate was formed, melting at 93°, which

*Constant at 120°.

corresponded in all respects with acetone-*p*-bromophenylhydrazone.

The molecular weight of gelsemine was determined by the cryoscopic method in acetic acid solution:

0.5250*, in 24.90 acetic acid, gave $\Delta t = -0.270°$. M.W. = 305.
$C_{20}H_{22}O_2N_2$ requires M.W. = 322.

In benzene solution association occurs, and numbers corresponding with twice this molecular weight are obtained:

0.6340*, in 20.70 benzene, gave $\Delta t = -0.248°$. M.W. = 605.
$(C_{20}H_{22}O_2N_2)_2$ requires M.W. = 644.

In order to ascertain whether gelsemine is homogeneous, a quantity was converted into its hydrochloride, and this salt recrystallized, first from dilute alcohol and then from water. The base was then regenerated, and, after crystallization from acetone, again analyzed:

0.1414* gave 0.3866 CO_3 and 0.0880 H_2O. C = 74.5; H = 6.9.
$C_{20}H_{22}O_2N_2$ requires C = 74.5; H = 6.8 per cent.

For further confirmation of the purity of the material, the base was converted into its nitrate. This salt, which forms glistening prisms, melting above 280°, was recrystallized from water, and the base regenerated from it. The product so obtained, after crystallization from acetone, gave the following results on analysis:

0.1462* gave 0.3980 CO_2 and 0.0906 H_2O. C = 74.2; H = 6.8.
$C_{20}H_{22}O_2N_2$ requires C = 74.5; H = 6.8 per cent.

The formula of the base deduced from these analyses is in harmony with the result obtained from the analysis of the hydrochloride.

Gelsemine forms a monohydrochloride crystallizing in small prisms, melting indefinitely at about 300°:

0.5614 gave 0.2310 AgCl. Cl = 10.1.
$C_{20}H_{22}O_2N_2,HCl$ requires Cl = 9.9 per cent.

A determination of its specific rotatory power gave the following result:

* Constant at 120°.

0.3100, made up to 20 c.c. with water, gave $[\alpha]_D + 0°5'$ in a 2-dcm. tube, whence $[\alpha]_D + 2.6°$.

The close agreement of these results shows conclusively that the empirical formula of gelsemine is $C_{20}H_{22}O_2N_2$.

A determination of its specific rotatory power gave the following result:

0.4066*, made up to 20 c.c. with chloroform, gave $[\alpha]_D + 0°39'$ in a 2-dcm. tube, whence $[\alpha]_D + 15.9°$.

Examination of the Amorphous Alkaloidal Products.

The alkaline, aqueous liquid from which the gelsemine had been removed by extraction with ether, as above described, was repeatedly extracted by means of amyl alcohol, when a relatively small quantity of an amorphous, basic product was obtained. This appeared to consist of a mixture, and two alkaloidal products were found to be present, one of which was much more strongly basic than the other. It was dissolved in chloroform, and extracted several times with 1 per cent. aqueous hydrochloric acid, which removed the more strongly basic product. The material obtained on rendering the acid extracts alkaline was isolated by means of chloroform, when it formed an amorphous, brown-colored product. Neither the free base nor any of its salts could be obtained in a crystalline condition. This more strongly basic product appears to correspond with the amorphous alkaloid to which the name "gelseminine" has been given.

The chloroform solution from which the "gelseminine" had been removed by means of 1 per cent. acid, as above described, was shaken many times with 10 per cent. aqueous sulphuric acid, which slowly removed a small quantity of a very weakly basic substance. As in the case of "gelseminine," neither the free base nor its salts could be obtained in a crystalline condition. This substance responds to the usual alkaloidal reagents, but appears to be stable only in the form of its salts, as on keeping a chloroform solution of the base for some time the product becomes insoluble in acids.

The alkaline aqueous liquid from which the alkaloidal products had been removed, as above described, was neutralized by means of

* Constant at 120°.

acetic acid and treated with a solution of basic lead acetate. This produced a voluminous yellow precipitate, which was collected, washed, and then suspended in water and decomposed by hydrogen sulphide. On filtering the mixture, a liquid was obtained which gave a bluish-black coloration with ferric chloride, and evidently contained a quantity of tannin, but no definite products could be isolated from it.

The filtrate from the basic lead acetate precipitate was treated with hydrogen sulphide for the removal of the excess of lead, and the filtered liquid concentrated under diminished pressure to a volume of about 2 litres. The concentrated liquid contained a considerable quantity of a sugar, as it readily reduced Fehling's solution, and yielded *d*-phenylglucosazone, melting at 208–210°.

One-fifth of the total liquid was diluted with water to 1 litre, about 50 grams of concentrated sulphuric acid, diluted with an equal weight of water, added, and the liquid repeatedly extracted with chloroform with the object of isolating any organic acids present. As this operation removed only a small quantity of acetic acid, the acid aqueous liquid was boiled for an hour and again extracted with chloroform, when nearly a gram of scopoletin was obtained. It thus appears probable that a glucoside of scopoletin was present in the original aqueous liquid, but all attempts to isolate this substance were unsuccessful.

Physiological Tests.

The following physiological tests were conducted in the Wellcome Physiological Research Laboratories by Dr. H. H. Dale, to whom the author now wishes to express his thanks:

A quantity (0.1 gram) of gelsemine hydrochloride, when injected intravenously into a rabbit, caused practically no effect, a result which is in agreement with an observation by Cushny.

One milligram of the hydrochlorides of both the amorphous bases, when injected intravenously into rabbits, caused death from respiratory failure in about twenty-five minutes, preceded by convulsions.

Summary.

The results of this investigation may be summarized as follows:

The material employed consisted of the dried rhizome and roots of *Gelsemium sempervirens,* Aiton.

An alcoholic extract of the drug, when distilled with steam, yielded a small amount of an essential oil. The non-volatile constituents, as obtained after treating the alcoholic extract with steam, consisted of a brown resin insoluble in water, and material which remained dissolved in the cold aqueous liquid. The resin, amounting to about 3.8 per cent. of the weight of the drug, yielded pentatriacontane; traces of emodin monomethyl ether; a phytosterol, $C_{27}H_{46}O$ (m. p. 136°; [α] −40.4°); a small amount of ipuranol, $C_{23}H_{38}O_2(OH)_2$; and a mixture of fatty acids, consisting of palmitic, stearic, oleic, and linolic acids. The portion of the alcoholic extract of the drug which was soluble in water, and from which the above-described resin had been removed, contained scopoletin (a monomethyl ether of æsculetin), which was present in the free state, and also in the form of a glucoside, together with a quantity of sugar. It yielded, furthermore, three alkaloidal products, one of which, gelsemine, has been obtained in a pure crystalline state, melting considerably higher than has hitherto been recorded (178°, instead of 160°), and which has been conclusively shown to possess the formula $C_{20}H_{22}O_3N_2$. The other alkaloidal products, one of which corresponds with the so-called "gelseminine" of Thompson (*loc. cit.*) and Cushny (*loc. cit.*), were amorphous, and no crystalline derivative could be obtained from them.

THE WELLCOME CHEMICAL RESEARCH LABORATORIES, LONDON.

RECENT STUDIES ON TURPENTINE OIL.[1]

The method of turpentine-production by the new "cup and gutter" system, which we have repeatedly described in detail, has, according to an American journal,[2] the disadvantage that the cups employed for collecting the balsam are often upset by hogs and other animals which scour the forest for food. Many of the earthenware cups, no matter how carefully they are handled, are lost by breakage, and, finally, a good deal of the turpentine oil is wasted by evaporation. All drawbacks, as well as the danger of fire, are said to be obviated by a new method in which the collecting-vessel and the tapping-place in the tree are connected in an air-tight manner. This is

[1] From Semi-annual Report of Schimmel & Co., April, 1912, pp. 122–130.
[2] *Scientific American* 105 (1911), 383.

done by boring into the sapwood of the tree a hole of 2⅜ inches diameter, and not too deep. From the centre of this hole two other holes, ¾ inch in diameter each, are bored steep upwards in a slanting direction, to the depth of a few inches. The rough bark surrounding the central opening is smoothed down to admit of the opening being closed with a flat cover. This cover communicates by means of a hollow prop with a second cover placed at right angles to the first, and into this second cover a glass receptacle, holding about one pint, is screwed air-tight. The turpentine collects first in the ¾-inch holes, and flows thence through the wider hole and the hollow prop into the glass receptacle which, when full, is replaced by another. It is said that this new method possesses several advantages over those now in use. Among these, in addition to the avoidance of the disadvantages enumerated above, are the preservation of the trees, coupled with the possibility of tapping them for an unlimited period; the prevention of loss by running or evaporation and the avoidance of the costly and destructive process of preparing the drawing-surface by cutting.

It appears to us, at any rate at first sight, that the considerably higher cost-price of the glass receptacles and metal-parts as compared with the simple earthenware cups and tin-strips of the "cup and gutter" method, will be a disadvantage of the new process.

Numerous investigations, especially by French chemists, have shown the pinene of the Aleppo fir (*Pinus halepensis*) to be specially rich in pure *d-α-pinene*. On the other hand, Fernandez [3] has found that the pinene from the Andalusian fir, which is identical with the Aleppo fir, is not quite identical with ordinary pinene. Unfortunately the abstract of Fernandez's paper before us gives no particulars of the constants of the pinene mentioned by him. He assumes the two pinenes to differ from each other because no nitrosites were obtainable from the Spanish pinene. When attacked by nitrogen tetroxide in the presence of acetic acid at 0°, a brownish-black body (probably an oxime) with a cymene-like odor was separated out. This body constituted about 55 per cent. by weight of the pinene used. The corresponding pinene nitrolpiperidine constituted a spongy, non-crystalline mass. With toluidine, Fernandez obtained high-boiling fluids which distilled over between 130 and 141° at 14 mm.; from the naphthylamines and the sulphanilic acid he was

[3] *Chem. Ztg.* 35 (1911), 1152. From a lecture.

unable to obtain nitrolamines. The Spanish pinene only afforded 10 per cent. crystalline terpene.

In the abstract at our disposal several points are left obscure. It is to be regretted that Fernandez does not state the constants of Spanish fir oil. We are uncertain what Fernandez means by his crystallized terpene,—whether camphene, prepared from conversion from the pinene hydrochloride or direct from the oil, or whether terpine? The fact that with aromatic bases such as aniline (and certainly also with homologous bases) pinene nitrosochloride does not afford nitrolamines, but pinene and amidoazobenzene is, we should think, generally known.

To our several notes [4] on Greek turpentine oil from *Pinus halapensis* we are now able to add the result of an examination by Parry [5] who has found two authentic samples to possess the following characters:

	I.	II
d_{15°	0,8605	0,862
α_D	$+36^\circ 45'$	$+39^\circ$
n_{D20°	1,4690	1,4736
Commences to distil at	156°	156°
Fraction 156 to 160°	70%	72%
α_D of 156 to 160° fraction	$+37^\circ 15'$	$+40^\circ$

In addition to the hydrocarbons *l*-pinene and sylvestrene, the presence of which in turpentine oil from *Pinus longifolia* we detected some time ago, [6] H. H. Robinson [7] has found the oil to contain dipentene. Robinson is of opinion that possibly sylvestrene may not be present as such in the original oil, but that the oil may contain a hydrocarbon which, when treated with hydrochloric acid, yields a sylvestrene derivative, in the same way as a hydrochloride results from the treatment of pinene which by splitting off the latter yields camphene.

When the turpentine from the Douglas fir (*Pseudotsuga Douglasii,* Carr) is distilled with steam under low pressure until all the turpentine oil has distilled over, there is left behind a clear, viscous yellow oil (Fir oil) which resembles the so-called pine oil from

[4] Report April 1905, 79; October 1905, 67; October 1909, 69.
[5] Perfum. and Essent. Oil Record 2 (1911), 210.
[6] Report April 1911, 116; October 1911, 93.
[7] Proceed. Chem. Soc. 27 (1911), 247.

common turpentine. According to Walker, and also Teeple,[8] this fir oil contains large proportions of terpineol. Benson and Darrin[9] have examined a sample of fir oil, and found it to possess the following constants: m. p. below—40°, $[\alpha]_{D20°}$—37.6°, $n_{D20°}$ 1,4818; solubility in 70 per cent. alcohol 49: 100, acid v. 1,55, sap. v. 11,1, iodine value 185. From its constitution and its behavior under fractionation, as well as from the readiness with which terpine hydrate was formed when the sample was treated with 5 per cent. sulphuric acid, the authors conclude that at least one-third of the oil consists of terpineol, and that for many purposes it may be found to supply a substitute for pine oil.

Queysanne[10] has proposed a purity-test for turpentine oil based upon its miscibility with aniline, and this same principle was subsequently adopted by Louise[11] in testing turpentine oil. The experiments of Queysanne with lævorotatory French oil have been amplified by investigations conducted by Gallon.[12] The samples of oil under examination possessed the following constants: $d_{15°}$ 0,8675 and 0,8682, $n_{D25°}$ 1,4668 and 1,4655, $\alpha_{D10°}$ + 40,32° and 39,99° respectively. The constants quoted in the second set of figures refer to another, but rather "older," sample of the same oil, the difference in age being shown in the somewhat slighter solubility of the "older" sample. But on the whole, the dextrorotatory oil was not so soluble in aniline as the lævorotatory sample which had previously been examined.

That the chemical testing of turpentine oil offers great difficulties is evident from the numerous publications on the subject. P. van der Wielen,[13] who has been engaged in the investigation of this oil, proposes a modification of the sulphuric acid method. To 80 c.c. sulphuric acid (d. 1,698) in a flask of about 1 litre capacity, he adds 20 c.c. of the oil under examination, and allows the mixture to stand for an hour under repeated shaking. After adding 300 c.c. water the oil which has not been attacked is distilled over into a bottle with

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[8] Comp. Report November 1908, 125.

[9] *Jour. Ind. Eng. Chem.* 3 (1911), 818. Quoted from *Jour. Soc. Chem. Industry* 30 (1911), 1407.

[10] Comp. Report April 1910, 115.

[11] Comp. Report October 1910, 139.

[12] P. E. Gallon, *Sur la solubilité réciproque de l'essence de térébenthine dextrogyre et de l'aniline.* Bordeaux 1911. From a reprint kindly sent to us.

[13] *Pharm. Weekblad* 8 (1911), No. 35.

a graduated neck. The coefficient of refraction as well as the separation temperature of the solution in aniline are determined. It is also necessary to know the refraction of the original oil. According to van der Wielen, an addition of hydrocarbons [14] may be detected positively from the above data as well as from the quantity of oil which has not been polymerized by sulphuric acid. The author has examined by this method a large number of samples of turpentine oil as well as various substitutes and mixtures with benzene, hydrocarbons and carbon tetrachloride, and has collected the results in table-form.

For determining the evaporation-residue of turpentine oil, Herzfeld, and also Kollo,[15] recommend the embedding of the platinum dish in a sand-bath, and the heating of the latter to 155° before filling-in the oil. In order to obviate the risk of explosion of the suddenly-generated vapor, a tin-ring is to be affixed below the rim of the dish. Wolff [16] has observed that when the dish is merely embedded in sand, the last particles of oil frequently creep over, and he obviates this trouble by surrounding the dish with a tin-cylinder about 2 inches in height and of a diameter exceeding that of the upper portion of the dish by nearly half an inch. This cylinder is stuck in the sand to a depth of about ¼ inch.

In view of the increasing importance of the so-called wood turpentine, as a result of the scarcity of genuine turpentine oil, the U. S. Department of Agriculture has caused two of its chemists, Messrs. Veitch and Donk, to report, in the detailed manner customary with this Department, upon the present experience relating to the production, refining and uses of wood turpentine.[17] The report deals in the first place with the production of the oil by the various processes in use: destructive distillation, steam-distillation, and extraction with volatile and non-volatile solvents. Of these, steam-distillation produces the most useful oil. The distillate obtained by the destructive process, that is to say the fraction which distils over up to 170° and which is also called " wood turpentine "

[14] By hydrocarbons the author apparently understands petroleum-hydrocarbons.

[15] Comp. Report April 1910, 116.

[16] *Farbenzeitung* 16 (1911), 2746. Quoted from *Chem. Zentralbl.* 1911, ii. 1181.

[17] Wood turpentine, its production, refining, properties, and uses. U. S. Dept. of Agriculture, Bur. of Chemistry, Bulletin No. 144, 1911.

is quantitatively too small in comparison with the oils of higher b. p. Moreover, it is much more difficult to remove the characteristic pine-tar odor of this product by refining, than is the case with the oil obtained by steam-distillation. The method of extracting with volatile solvents is still in its infancy, but several plants use the method of extracting with hot rosin at 200°, which extracts the oil from the chipped wood. The rosin yields the oil to a current of superheated steam which is passed through it, and is afterwards used again for extracting fresh batches of wood. There is also a method of extracting the oil and resin from the wood by boiling the latter with soda liquor and removing the oil from the liquor with a steam-current before the rosin acids are precipitated; the cellulose of the raw material being worked up for paper. Of course the residual wood from the steam-distillation or the extraction with volatile solvents can also be made into paper-pulp or used for dry distillation.

Great importance is to be attached to the next process of purifying and fractionating the crude distillate, for which purpose a column-still either working intermittently or continuously, should be used. The distillate resulting from the destructive process is first freed from phenols by means of alkali and then refined by steam-distillation. Generally speaking, insufficient care is bestowed upon this work, and apparently the distillate is not fractionated; hence "carbonization wood turpentine" is not to be regarded as a first-class product, owing to the considerable proportion of high-boiling oils contained in it. The portions of this oil which distil over between 80 and 154° closely resemble rosin spirits; the fraction boiling between 154 and 180° constitutes the destructively-distilled wood turpentine. It contains pinene, dipentene and other compounds which also occur in part in rosin spirits. The higher-boiling oils, with b. p. exceeding 180°, are mixtures of pine-tar and rosin oils in indefinite proportions and are used as greases and solvents, in the manufacture of printers' inks, etc. The constitution of the crude product of the steam-distillation of light wood is very different from the above. As a rule it is collected in the following two or three fractions: wood turpentine proper, b. p. 150–160° up to 175–180°; light pine-tar oil, b. p. 170–180° up to 210–225°; heavy pine-tar oil, b. p. 180–190° up to 230–240°. The first fractions contain chiefly pinene, also camphene, limonene, dipentene, and cineole, and (in case of careless fractionation) more or less terpinene, borneol, and terpineol. The pine-tar oil portions contain, in addition to small

proportions of the terpenes, chiefly terpineol, borneol and fenchyl alcohol. A great many attempts have been made to free wood turpentine from its characteristic objectionable odor. It is true that the very first fractions of the steam-distilled oil have a pure odor, but the yield is too small to justify the rejection of subsequent fractions to make it practicable to collect them by themselves, and perhaps to disregard the succeeding fractions. Special experiments carried out by the Department have shown that the unpleasant odor attaches principally, although not entirely, to the higher boiling portions which are still included in the low-boiling fraction, and special importance is to be attached to the removal of these by carefully-conducted fractionation. When this is done, however, wood turpentine very closely resembles genuine turpentine oil, both in its odor and in its constitution. The following table shows the properties of the usual commercial turpentine oils:

Constants	Gum Turpentine oil	Wood turpentine oil	
		Steam-distilled	By destructive process
$d_{20°}$	0,8617 to 0,8889	0,859 to 0,915	0,857 to 0,898
$a_{D20°}$	−34,8° " ×29,6°	+16,5° " +36,14°	+34,4° " +77,6°
$n_{D20°}$	1,4684 " 1,4818	1,4673 " 1,4755	1,4666 " 1,4810
Initial distilling point (uncorr.)	154 " 159°	153 " 177°	150 " 169°
Distilling below 170°	73 " 99%	0 " 95%	0 " 93%
Distilling below 185°	88 " 99%	20 " 98%	61 " 97%
Iodine value according to Wijs	350 " 400	300 " 362	300 " 398
Acid v	0,140 " 0,286	0,080 " 0,312	0,028 " 0,246
Sap. v	2,44 " 8,60	1,06 " 8,75	0,65 " 4,32
Color (Lovibond) ...			
for yellow	0,7 " 2,5	0,5 " 10,0	0,4 " 4,5
for red	0,0 " 0,5	0,2 " 1,4	0,0 " 0,8

The iodine-value is regarded as of significance, inasmuch as it indicates the proportion of heavy oil; but similar conclusions may be drawn from the saponification-value. Comparison of the crude with the rectified oils and their constants shows that rectification, as it is carried out in practice up to the present, hardly improves the quality, but only produces a distillate of a paler color. The authors of the report go into full details on the subject of the experiments in fractionation which they conducted on a large scale, both in a simple and

in a column still with direct steam. So far the record of the working showed no considerable difference in the action of the two stills, but it is said that no definite judgment can yet be formed. So far as the evaluation of an oil-fraction in respect of its value as good, low-boiling wood turpentine is concerned, neither the often varying temperature of the steam which passes over, nor the specific gravity of the oil-particles is conclusive, but rather, according to practical experience, the respective proportions of oil and water in each fraction that distils over. The higher the proportion of oil, the more closely the properties of the oil approximate those of a good wood turpentine. When the total-distillate contains 55 per cent. oil or more, the proportion of good oil boiling below 170° is 90 per cent.; when the total proportion of oil ranges from 55 to 30 per cent., renewed steam-distillation is needed in order again to obtain a light portion containing 55 per cent. of good oil (as before). Finally when the oil-content of the total distillate falls below 30 per cent., it consists entirely of high-boiling oils, which it is unnecessary to try to work up for oils with b. p. below 170°.

With a view of deciding the important question to what extent the various wood turpentines could be used in the manufacture of paints and varnishes side by side with gum spirits, several varnishes were prepared with four samples of commercial oils, consisting of one sample each of guaranteed pure oil from gum of a steam-distilled wood turpentine, and two wood turpentines prepared by the destructive process and subsequently washed with soda and steam-distilled. In connection with these experiments it is expressly stated that, apart from one of the two samples last-mentioned, the wood oils contained large proportions of heavy oil, from which they derived a pronounced odor, and which caused the varnishes prepared with them to dry more slowly than usual. It is evident that varnishes prepared with oils of this description must give less satisfactory results than when a well-rectified oil had been used. From each of the four samples two kinds of varnishes were prepared, a coach finishing varnish and a piano varnish, with a view of testing their qualities under different atmospheric influences. We are unable to quote here the very detailed reproduction of the reports of the numerous firms which instituted these tests; partly preparing the varnishes themselves, and partly using them only. The disagreeable odor and the irritant action of the wood turpentine are generally commented upon; on the usefulness of the varnishes themselves

the opinions differ. On the other hand the producers of wood turpentine of course claim that their productions are entirely suitable for the manufacture of paints, varnishes, etc.

We are now able to complete, on the authority of an American report, the particulars given in our last Report (p. 92) concerning the output of the various products of the American wood-distilling plants.[18] From this it appears that in the year 1910 thirty plants were engaged in the distillation of soft woods, principally yellow pine, together with small quantities of Norway pine and Douglas fir. The plants turned out an aggregate of 192,442 cords soft wood, as compared with 115,310, 99,212, and 62,349 cords in the years 1909 to 1907—a proof of the increasing importance of the wood-turpentine industry.

In view of the large imports of Finnish and Swedish pine-tar oil into France, which are probably due principally to the prohibitive customs duty upon pure turpentine oil, a brief essay by Blarez and Vèzes[19] on the properties of pine-tar oil from Northern Europe should be very useful to all those in France who are interested in oil of turpentine. In making comparisons between genuine turpentine oil and pine-tar oil, the following general characteristics of the latter chiefly deserve consideration: its very marked empyreumatic, unpleasant odor; its lower sp. gr. ($d_{25°}$ 0,8520 to 0,8570); its lesser degree of volatility, a property which varies considerably in different samples; its higher co-efficient of refraction (n_D 1,4700 to 1,4800) which also varies in the separate fractions, and, finally, its dextro-rotation (α_D + 4 to + 5°). Other points of difference are the readiness with which pine-tar oils dissolve in aniline, and Herzfeld's reaction. Mixtures of pine-tar oil with turpentine oil from the Landes may be detected and quantitatively estimated most readily by determining the rotation and by the temperature at which a mixture with known quantities of aniline separates.

To detect the presence of pine-tar oil in turpentine oil, Herzfeld has recommended the shaking of the latter with an equal volume of solution of sulphurous acid (yellow coloration denotes the presence of pine-tar oil; comp. Report April, 1905, 78). Herzfeld has also recommended another test, consisting in pouring the oil under

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[18] *Oil, Paint and Drug Reporter* 80 (1911), No. 26, p. 9.

[19] *Sur l'essence de pin des pays du Nord de l'Europe.* Bordeaux 1911. From a reprint kindly sent to us.

examination over a piece of caustic potash, when the presence of pine-tar oil is revealed by the caustic potash rapidly assuming a brown color (Report April, 1910, 110). H. Wolff [20] has modified the last-named test by shaking up 0,5 to 1 c.c. potash liquor (d 1,3) with the oil, warming the mixture on the water-bath for 2 to 5 minutes, and then adding 3 c.c. water to separate the emulsion. Pine-tar oil causes the aqueous layer to assume a brown color, turpentine gives none, or only a very faint color. Wolff gives two more tests for pine-tar oil which we quote below, without expressing an opinion on their value:

1. Five c.c. oil are brought to boiling with 5 drops nitrobenzene, when 2 c.c. (25 per cent.) hydrochloric acid are added and the mixture is kept boiling for 10 seconds more. Pine-tar oil turns brown, the hydrochloric acid brown to black. Turpentine oil gives much paler tints.

2. To a mixture of 4 c.c. each of ferric chloride (1:2500) and potassium ferricyanide solution (1:500) add from 2 to at most 10 drops of the oil to be tested and shake the whole vigorously. Pine-tar oil will rapidly give a copious precipitate of Prussian blue, whereas turpentine oil only gives a perceptible separation of that body after the lapse of some hours.

C. Piest [21] proposes the following reaction to effect the same object:

Shake in a test-tube 5 c.c. acetic anhydride with 5 c.c. turpentine oil, and add 10 drops concentrated hydrochloric acid while shaking and cooling. When the mixture has cooled down completely add, with shaking, 5 drops more of concentrated hydrochloric acid; this will cause the liquid to become warm and to make a clear solution. Turpentine oil then remains water-white, pine-tar oil turns black.

In every case the turpentine oil, whatever its origin, should be distilled before being tested.

In commenting upon a paper by Grimaldi on the detection of camphene in light resin oil and in other oils,[22] we took exception, in a footnote, to the use by Grimaldi of the designation "turpentine-

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[20] *Farben Ztg.* 17 (1911), 21, 78. Quoted from *Chem. Ztg.* Repert. 36 (1912), 64.

[21] *Chem. Ztg.* 36 (1912), 198.

[22] Report April 1911, 118.

essence" for light resin oil, because, especially in translating, the term encourages confusion with turpentine oil. In a letter which he has addressed to us Grimaldi disowns the authorship of the term, and declares that he has taken it from a paper by Valenta,[23] who may possibly have borrowed it himself. It is also necessary, Grimaldi observes, to differentiate between turpentine essence, and light resin oils or pinoline; the last-named being that product of the distillation of colophony which passes over at up to about 230°, whereas "turpentine essence" constitutes the most volatile fractions of that distillation, boiling over between 160 to 170°.

We admit that in our footnote we drew no such sharp distinction between the two distillates, as we did in previous Reports.[24] That, anyhow, was not our principal object, which was chiefly to enter a protest against the use of the name "turpentine essence" as inappropriate, without, however, expressing an opinion on the authorship of the term. And on the point to which we attach the most importance, Grimaldi agrees with us.

BOOK REVIEWS.

INDUSTRIAL ORGANIC CHEMISTRY. Adapted for the use of manufacturers, chemists, and all interested in the utilization of organic materials in the industrial arts. By Prof. Samuel P. Sadtler. Fourth Edition (Revised, Enlarged and Reset). Philadelphia: J. B. Lippincott Company. London: 5 Henrietta Street, Covent Garden, 1912.

It is now a little more than twenty years since the first edition of Professor Sadtler's Industrial Organic Chemistry was published. While it is true there were a number of standard German and French works, as well as excellent dictionaries of applied chemistry, upon the market at that time, yet there was and is a pressing need felt by industrial chemists in the United States and England for a work giving succinctly and yet thoroughly the results of modern investigations which are scattered in a number of excellent technical jour-

[23] *Chem. Ztg.* 29 (1905), 807; Report October 1905, 70.
[24] As, for example, Report October 1905, 71; April 1908, 105.

nals, and embodying present day practices in the various large industries. The first edition was upon the market but a few years when it became exhausted so that a new edition appeared in 1895. This was followed by a third edition in 1900, which has been practically out of print for several years past. A new edition was not published, as the author, who is one of the most eminent consulting chemists in the United States, an author of a number of excellent works on chemistry and a professor of chemistry, could not "take up the careful review of the field of industrial organic work required for a proper revision of this book."

Fortunately he has been able recently to revise the work and we now have this standard work brought up to date with the inclusion of new matter in nearly every chapter and the description of many new technical products. Full and accurate statements regarding the newer industries are also given for the first time, such, for example, as those relating to the artificial silk industry, the by-product coke oven, the manufacture of synthetic indigo, etc.

While, of course, Sadtler's Industrial Organic Chemistry is especially valuable to the manufacturer in the industrial arts and to students of applied organic chemistry it will also be found to be of very great use to pharmaceutical manufacturers. Probably in no one work will one find so much information on subjects which either directly or indirectly concern him as in the volume at hand. The following are some of the industries that are thoroughly described, the products of which are of very great interest to pharmacists: industry of fats and fatty oils, industry of essential oils and resins, cane sugar industry, fermentation industries, milk industries, glue and gelatin manufacture, industries based upon destructive distillation, as of wood and coal, the manufacture of artificial coloring matters, and natural dye colors. The chapters dealing with these various industries are also supplemented with an extensive bibliography and with facts of statistics which will be found invaluable to the pharmaceutical analyst and manufacturer. The amount of information which is here available will save anyone interested in these subjects a vast amount of time. No one except a specialist of long standing, with excellent literary ability and sound judgment could possibly present in 600 pages this vast amount of well-digested material that we find in the present volume. The mechanical part of the book is in consonance with the subject matter. The proof reading has been well done. It is practically free from errors and the

author and publishers are to be congratulated upon the appearance of the present volume.

THE BRITISH PHARMACEUTICAL CODEX. An imperial dispensatory for the use of medical practitioners and pharmacists. Published by direction of the council of the Pharmaceutical Society of Great Britain. London: The Pharmaceutical Press, 72 Great Russell Street, W. C., 1911.

The first edition of this excellent work was published in 1907. Naturally it was subject to extensive criticism and discussion, and as the Council invited the pharmacists of the British Empire to cooperate in rendering the Codex more generally useful and valuable as a book of reference, much valuable material for revision was received. The revision of the new work was entrusted to Mr. John Humphrey, well known as the author of excellent pharmaceutical books and papers. With a corps of collaborators and associates Mr. Humphrey has been enabled to prepare a most commendable work, one that reflects his excellent judgment and ability and that is most creditable to the Council of the Pharmaceutical Society of Great Britain. Any pharmacist, whether he reside in Great Britain and her colonies or in the United States and that does not have the Codex for use in the laboratory and behind the prescription counter, can hardly appreciate under what serious disadvantages he is working. The book contains a vast amount of useful information relating not only to official substances but to nearly all the unofficial products which are generally used, and is practically indispensable to the dispensing as well as manufacturing pharmacist.

ALLEN'S COMMERCIAL ORGANIC ANALYSIS. Vol. VI. Fourth Edition. Entirely rewritten. Edited by W. A. Davis and Samuel S. Sadtler. Philadelphia: P. Blakiston's Son & Co., 1012 Walnut Street, 1912.

The editor of this JOURNAL has repeatedly called attention in the reviews of the preceding 5 volumes of Allen's Commercial Organic Analysis to their value to the manufacturing pharmacist. The present volume, treating as it does of the alkaloids, alkaloidal drugs and their assays, will be sure to be of very great interest to pharmacists generally. The subjects covered include the following: amines and ammonium bases; aniline and its allies; naphthylamine, pyridine, quinoline and acridine bases; vegetable alkaloids; volatile bases of vegetable origin; nicotine and tobacco; aconite alkaloids; atropine and its allies; cocaine; opium alkaloids; strychnos alkaloids; cin-

chona alkaloids; berberine and its associates; caffeine, tea and coffee; cocoa and chocolate.

RUDIMENTS OF LATIN, with special reference to the nomenclature of the U. S. Pharmacopœia, the National Formulary and the text-books in Materia Medica and Botany, including also prescription writing and notes on the nomenclature of the German Pharmacopœia. By Prof. Julius W. Sturmer, Purdue University. Second Edition. Published by the author. 1912. $1.25.

One of the pleasing signs in the development of the science and art of pharmacy is the fact that instruction in the rudiments of Latin is now given in very many of the colleges and schools of pharmacy in the United States. Apart from the question whether Latin should be obligatory or elective preliminary requirement, experience has shown that all students are benefited by the instruction on this subject. Accuracy in the use of Latin titles is as necessary to the pharmacist as accuracy in the employment of chemical symbols or weights and measures. Furthermore the study of the origin and derivation of pharmacopœial names shows that the latter are not given arbitrarily but are the result of thought and learning.

Professor Sturmer's work is too well known to require an elaborate review at this time. It is sufficient to say that it meets existing conditions very well and it were well if pharmacists generally had this work in their libraries. It is a splendid book for the student and is doubtless quite generally employed by teachers in colleges of pharmacy in the United States as a text-book.

HANDBUCH DER PHARMAKOGNOSIE von Prof. A. Tschirch. Lief. 26–30. Leipzig: Chr. Herm. Tauchnitz.

It is always a pleasure to learn that additional numbers of the Lieferungen of Tschirch's Handbook on Pharmacognosy are available. The admiration with which we have on previous occasions referred to this remarkable work continues as the work progresses. Again and again we find in this work an exhaustive treatment of the substances which are becoming more or less extensively used, but which are not generally considered in the text-books or works of reference, as agar-agar, kieselguhr, characteristics of the different kinds of arrow-root starch, fixed oils, mannas, etc.

It is almost unnecessary to state again that Tschirch's Handbook is indispensable to research students and manufacturing pharmacists and should be in the libraries of all colleges and universities where

information is sought concerning products of vegetable and animal origin.

THE ART OF DISPENSING. A treatise on the methods and processes involved in compounding medical prescriptions, with dictionaries of abbreviations and terms used in British and foreign prescriptions, incompatibles and new remedies, and numerous memoranda for dispensers and prescribers. By Peter MacEwan, editor of *The Chemist and Druggist.* Ninth Edition. Published at the offices of *The Chemist and Druggist,* 42 Cannon St., London, E. C. 1912. 6s. net.

A new edition of this work has just been published. It is the ninth since the treatise first appeared in book-form in September, 1888. It has been critically revised throughout, a great deal of new matter being added, which may be exemplified by some excerpts of additional annotations in the chapter on pills.

THE PILL SPATULA (p. 78).—"It should be straight across at the point and sharpened so as to scrape well. Most pill spatulas supplied by sundries houses are too thick at the point."

SOFT MASSES (p. 84).—"A pill-tile placed over a small water-bath is convenient and rapid [for reducing the softness of a mass]. Experience indicates that it is well to make an allowance of 3 or 4 per cent. for loss, as it is practically impossible to scrape *all* the dried extract off the drier."

ALTHÆA AS AN EXCIPIENT (p. 87).—Another good excipient powder for such things as carbolic acid is a mixture of equal parts of althæa and licorice. For carbolic acid "some prefer flour with 3 per cent. of powdered tragacanth and, if required, a little syrup to moisten."

RESIN OINTMENT makes good pills of ferri et quininæ citras and similar articles which cake with aqueous excipients.

CARBOLIC-ACID PILLS (p. 98).—"The modern tendency is to use a dilute mass—1 of acid in 4 or 5—and to make it firm so that the pills will not dissolve quickly."

FERRI PROTOCHLORIDUM (p. 116).—"An excellent mass, which allows leisurely manipulation, is made by adding about an eighth of its weight of powdered liquorice-root and sufficient anhydrous wool-fat to mass."

FERRI ET AMMONII CITRAS (p. 116).—"Proof spirit makes an excellent mass, which has to be finished off quickly. Pills of this salt . . . should be dispensed in a well-corked vial."

FERRI SULPHAS (p. 116).—"Liquid glucose is a perfect excipient for the dried salt; 36 grains require about 12 grains."

PIL. COLOC. CO. (p. 123).—"An excellent mass is made by adding 10 grains of powdered tragacanth to 180 grains of the species and massing with 15 minims of water. Pills made in this manner take a fine polish and retain their shape well."

It may be recalled that the plan of "The Art of Dispensing," after the discussion of principles and compounding operations and dispensing practice generally, is to deal with solid forms of medicines, beginning with Pills, after which there are chapters on Tablets, Lozenges, and Pastilles, one on Capsules, another on Powders, the next on Suppositories, Bougies, and Pessaries, then come Ointments, Plasters, and Pastes and Jellies, which link the foregoing with liquid medicines; these begin with Mixtures. Then follow chapters on Emulsions and on Applications. The last-named was originally a modest chapter of six pages, entitled "Lotions, Liniments, and Injections," but now it deals with Lotions, Injections, Ampoules, Embrocations, Liniments, Sprays, and Inhalations, and consists of 27 pages. It is followed by a chapter on Incompatibles, which is as popular with "authors" as it is with dispensers. A chapter on Foreign Prescriptions follows this, and contains many modern examples of French and German prescriptions; while as a supplement to the chapter we may mention that the old Dictionary of Terms used in French and German prescriptions has been extended into a more exhaustive one, embracing also Dutch, Italian, Norwegian, Portuguese, and Spanish terms. "New and Unofficial Remedies" in the first five editions of the book were embraced in 12 pages devoted to 53 specific articles. Now the chapter extends to 58 pages of double-column matter in smaller type, and it contains notes on over 700 specific articles. The chapter is one of the most striking examples of the innovations which have been made in dispensing-practice during the past two decades. It has proved to be most serviceable to the pharmacists of the British Empire, and gives the dispenser practically all that he wants to know as to the compounding of these remedies and their modes of administration, as well as the doses and any other points which may be of service in the dispenser's relations with the prescriber.

"The Art of Dispensing" is one of the most helpful books that has been published for the use of the retail pharmacist. The apothecary that has stopped in his education and refuses to see any better way of doing things is doomed ultimately to see his trade going to those men who are keeping up with the march of progress. Mr. MacEwan has the rare good fortune as editor of the *Chemist and Druggist* to know quite well the prevailing practices in the stores throughout Great Britain and fortunately has a mind capable of selecting and assimilating the good ideas of the many pharmacists,

with whom he is continually thrown in contact. He has brought the results of his observations into concise and readable form in "The Art of Dispensing," which is a work that will be found not only useful but stimulating to the man behind the prescription counter. It is growing to be more and more highly appreciated by the pharmacists in the United States.

METHODS OF ORGANIC ANALYSIS. By Prof. Henry C. Sherman, Columbia University. Second edition. Rewritten and enlarged. New York: The Macmillan Company, 1912. $2.40 net.

This book was prepared as a laboratory guide in organic analysis, especially of plant and animal substances and their manufactured products. The greater part of the book is devoted to the consideration of the quantitative methods employed in the study of food materials and related substances. It is well adapted to class-room work and where it has been adopted has been found successful. The scope of the work has been somewhat extended, the new matter including matter of particular interest to pharmaceutical chemists, as the new international methods of glycerin analysis, the quantitative methods for the testing of enzymes, and discussions on detecting food preservatives, etc. On account of the thoroughness with which the analytical processes are described and the extensive citations to the literature the work will prove of the greatest value to students in organic analysis as well as the professional analyst.

DIGEST OF COMMENTS ON THE PHARMACOPŒIA OF THE UNITED STATES OF AMERICA AND ON THE NATIONAL FORMULARY. For 1909 and 1910. By Murray Galt Motter and Martin I. Wilbert. Washington: Government Printing Office, 1912.

The volumes for 1909 and 1910 of the Digest of Comments have recently been issued as Bulletins 79 and 84 respectively of the Hygienic Laboratory of the Public Health and Marine-Hospital Service. In view of the facts that the readers of this JOURNAL are for the most part thoroughly familiar with these Bulletins, it is not necessary to attempt to write reviews of them or to describe the progress in pharmacy during the years 1909 and 1910. From a rather careful perusal of these volumes it is quite apparent that not much, if anything, appears to escape the attention of the authors of these "Digests." The work throughout has been very painstaking and thorough and even typographical errors, if they occur, have not been detected by the reviewer. The point of view of the authors is excellent and their sympathies are rather broad. Further-

more, they are able to see the point of an article and express the results of a writer in the tersest language possible. The "Digest of Comments" might well be employed as standard books of reference in the cirriculum of the colleges and schools of pharmacy throughout the United States.

THE MEETING OF THE AMERICAN MEDICAL ASSOCIATION.

The sixty-third annual session of the American Medical Association, held in Atlantic City, N. J., June 4–7, 1912, was attended by 3600 physicians from all sections of the country and will long be remembered as one of the most successful meetings of the Association. Upwards of 400 papers were read and discussed in the fourteen Sections of the Association and as in former years pharmacy, at least in its broader scope, was given considerable attention.

Among the more interesting happenings must be reckoned the revision of the principles of medical ethics as agreed to by the House of Delegates. These principles as now enunciated are broad in their scope and can readily be subscribed to all by true practitioners of medicine. Section I defines the object of a profession as follows:

"A profession has for its prime object the service it can render to humanity; reward or financial gain should be a subordinate consideration. The practice of medicine is a profession. In choosing this profession an individual assumes an obligation to conduct himself in accord with its ideals."

Section 4 of Chapter 3 relates specifically to the practice of pharmacy and reads as follows:

"By legitimate patronage, physicians should recognize and promote the profession of pharmacy; but any pharmacist, unless he be qualified as a physician, who assumes to prescribe for the sick, should be denied such countenance and support. Moreover, whenever a druggist or pharmacist dispenses deteriorated or adulterated drugs, or substitutes one remedy for another designated in a prescription, he thereby forfeits all claims to the favorable consideration of the public and physicians."

The proceedings of the Section on Pharmacology and Therapeutics were of unusual interest to pharmacists and not a few members of the American Pharmaceutical Association from Philadelphia, New York and other cities attended the sessions of this Section and

took part in the discussions. Professor Joseph P. Remington at the opening session of the Section presented an address as Chairman of the delegation from the American Pharmaceutical Association and the members of the American Pharmaceutical Association present were on motion accorded the privileges of the floor.

Among matters of direct interest to pharmacy discussed by this Section, the first on the program is embodied in the symposium on patents and trade-marks. The discussion on this subject was participated in by retail druggists, physicians, manufacturers and others interested in the granting or non-granting of patents on commercial substances used as medicines. As a direct outcome of the discussion a Committee was appointed to request that the Board of Trustees of the American Medical Association sue for the annulment of the trade-mark registration of an article used as medicine. On motion the Section on Pharmacology and Therapeutics resolved that the delegate of the Section to the House of Delegates be instructed to request that the House of Delegates instruct the chairman of the Council on Health and Public Instruction to endeavor to secure a modification of our American Patent Laws eliminating product patents on chemical substances used as medicine.

The desirability of a more restricted materia medica was discussed from the standpoint of the chemist by W. A. Puckner, Chicago, that of the pharmacist by Henry P. Hynson, Baltimore, of medical instruction, by E. Lefevre, New York, the medical practitioner by Oliver T. Osborne, New Haven. Further discussion was participated in by a number of the members present, the general outcome of the discussion being in harmony with the proposed action of the Committee on Useful Remedies of the American Medical Association to present for discussion and general use a list of important medicaments to which examination in materia medica subjects by state medical examining and licensing boards might be restricted, and which list might be used as the basis for instruction in materia medica subjects by teachers in medical schools.

In a joint meeting with the Section on Preventive Medicine and Public Health the use of intestinal antiseptics and the standardization of disinfectants were discussed at length, and it was shown that many of the commercially available disinfectants were inefficient and that satisfactory standardization of this class of articles must be insisted on.

Dr. Robert A. Hatcher, New York, and Dr. Carey Eggleston,

New York, presented comprehensive papers on the action of digitalis and digitalis-like bodies, and these communications will no doubt go far toward establishing more definite knowledge of these important drugs.

A symposium on drug standards and drug standardization was participated in by Professor Joseph P. Remington, who presented a report of progress of the U.S.P. revision; L. F. Kebler, who discussed the quality of drugs on the market; R. H. True, who reviewed the experiments made in drug cultivation by the Bureau of Plant Industry of the United States Department of Agriculture; Horatio C. Wood, Jr., who discussed the ideals and limitations of bio-assay; Henry Kraemer, who reviewed the history and the possibilities of the retail pharmacist as a purveyor of pure drugs, and Julius H. Comroe, who discussed prescribing versus dispensing on the part of medical practitioners.

The concluding symposium, of the section program, on anæsthesia, was one of vital importance, not alone to physicians and pharmacists but also to patients generally who must assume the risks attending general or partial narcosis. In the course of this symposium Professor Charles Baskerville, of New York, presented a comprehensive review of the work that he and his students have done on the chemistry of inhalation anæsthetics and incidentally pointed out the differences now existing in the standards for the several anæsthetics included in different pharmacopœias. He asserted that these standards varied widely and that many, including those of the U.S.P., permitted the presence of dangerous contaminations that should not be allowed. Statistics relating to mortality from anæsthetics were discussed by several physicians and the use of spinal anæsthesia or analgesia was commented on at length. Altogether, the papers presented in this symposium will well be worth careful perusal on the part of pharmacists who are interested in supplying the best that the market affords in the way of anæsthetics and of preventing contamination or adulteration of the articles supplied by them.

The meeting of the American Medical Medical Association, in 1913, will be held in Minneapolis, in June.

M. I. WILBERT.

Fig. 1

ERYTHROPHLOEUM GUINEENSE, G. Don.
A felled tree, in the Belgian Congo, from which the so-called "Sassy Bark" or "Nkasa" had been collected for many years.

Fig. 2

In the foreground of this picture are to be seen a few bones, the remnants of a victim of witchcraft who had been burned after receiving a fatal dose of "Sassy Bark" or "Nkasa" (ERYTHROPHLOEUM GUINEENSE, G. Don).

Reproduced from photographs by Iner C. Wickware, Boma, Belgian Congo.